



# E-embroidery: Soft Circuits Aesthetics applied to Traditional Craft

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As the tradition of Portuguese embroidery faces a struggle for preservation and valorization, artistic research can reinvigorate its status in the cultural system, through an encounter between tradition and modernity. Emerging digital art practice embodies code as a medium for artistic expression and promotes a re-casting of both the artisan's and the designer's work, pushing them to discover new domains of artistic creation and to adopt new materials and materialities.

This paper presents a practical enquiry on the application of *Soft Circuits* as raw material, tool and content in the process of transforming traditional Portuguese embroidery into digital interactive artifacts, converging Art and Science, enhancing artisan skills, and dealing with issues of ethics, participation/collaboration, social innovation and, ultimately, cultural sustainability.

**Keywords** Traditional  
Embroidery, Contemporary  
Aesthetics, Soft Circuits,  
Cultural Sustainability

## 1. Introduction

The symbiosis between art and technology, the reality of Portuguese traditional embroidery and its effort to preserve and enhance it, the reinvention of an imaginary and the appreciation of artisan skills, ethical issues and cultural sustainability, as well as the paradigm of contemporary aesthetics that, through interaction, lead us to the endogenous experience and reality, compose the axis of this research. It arises as a reflection on the contribution of electronic materials, soft circuits specifically, when applied as raw material, tool or content in the sustainability of traditional embroidery from Portugal, redesigned as an interactive digital artifact in contemporary imaginary.

In this article we analyze the use of soft circuits in digital artifacts, considering soft circuits both as a resource for e-embroidery and also as an expressive element of the project in the scope of cultural sustainability. We illustrate with the presentation of Filozell-e, an interactive digital artifact we produced and exhibited as part of our practice based research. We discuss the aesthetics of soft circuits focusing on electronic components specifically designed for wearables and e-textiles - *Lilypad (Arduino)*<sup>1</sup> and *Flora (Adafruit)*<sup>2</sup> - applied to traditional embroidery. We conclude with a vision for aesthetics in e-embroidery, perceived from processes of reinvention, renewal and innovation in the context of cultural sustainability.

1. <https://create.arduino.cc/projecthub/products/arduino-lilypad-main-board>

2. <https://www.adafruit.com/category/92>

## 2. Soft circuits applied in Embroidery: State of the Art

*“Open-source programmers and crafters may seem like they come from different worlds. Still, the two communities have much in common”, as the Open-Source Embroidery founder and curator of the namesake exhibition Ele Carpenter states. This British movement brings together knitters, embroiderers and quilters “who see parallels between the way they create their crafts and how open-source software creators share their ideas” (Priya 2009).*

Recent developments in physical computing are exposing us to new forms of use of electronic materials, which reveal a shared philosophy and methods between craft and technology in its growing applicability in artistic and cultural contexts.

### 2.1 Case Studies: Artists working with Soft Circuits embedded in Embroidery

An emerging community creatively explores and shares instructional tutorials to create flexible circuits or interactive textiles, involving artists and programmers such as Leah Buechley and Hannah Perner-Wilson (Buechley et al. 2010; Perner-Wilson 2014).

In this context, the *High Low Tech* research group at the MIT Media Lab (2009 to 2014) led by Leah Buechley and involving artist researchers like Hannah

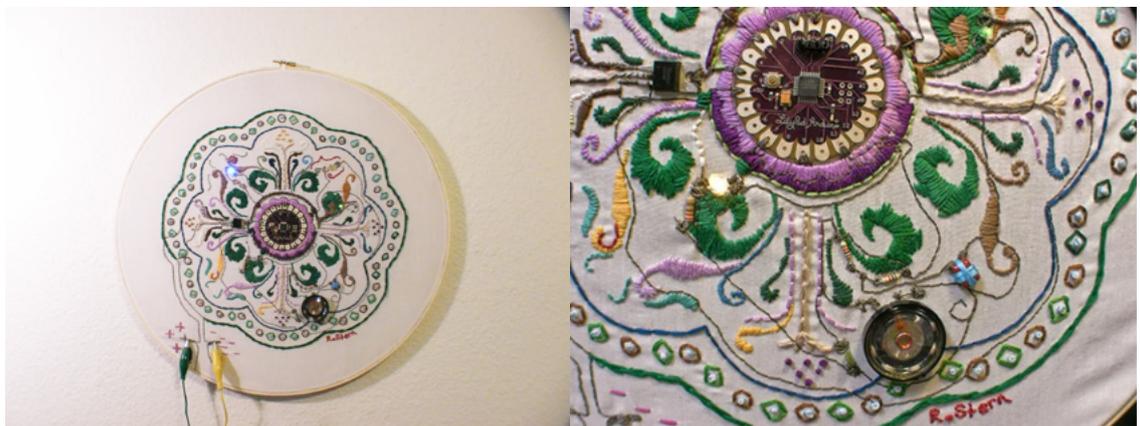
Perner-Wilson, among others, explored the intersection of physical computing, electronic materials, manufacturing processes, traditional crafts and design (Fig. 1). With the aim of placing computing in new cultural and material contexts and developing tools that democratized electronic materials, the main objective was to involve different audiences in the design and implementation of their own technologies.

Fig. 1. Examples of projects of the work developed in the High Low Tech research group.  
Source: <https://highlowtech.org>



The aesthetics of the e-textiles microcontrollers are progressively making part of the visible interface, assuming a hybrid aesthetics that combines embroidery using traditional materials and techniques mixed with interactive electronics with outputs – lights and sounds, for example – generated by the onboard software. Becky Stern’s open-source work (Fig. 2) embedding the *Lilypad* microcontroller and sensors in customized embroidery (Stern 2014) is an output at the crossroads of this hybridization.

Fig. 2. LilyPad embroidery  
A Tribute to Leah Buechley,  
created by Becky Stern.  
Source: <https://beckystern.com/2008/04/21/lilypad-embroidery/>



Teresa Almeida explores the possibilities of soft circuits as socially engaged participative activities, thus developing a conceptual framework for a woman-centered approach through a design methodology that embraces practical interdisciplinary design research, such as working with e-textiles (Almeida 2019). Group activities become workshops. The objective is to explore electronic circuits, using technologies for creative expression and demystifying knowledge of electronics, as can be seen in *Geek Art: Needlework*, which brought together programmers and artisans. Founded in 2005, the *Open-Source Embroidery*<sup>3</sup> movement is made up largely of knitters, embroiderers and programmers. This social development project grew to support and facilitate the practice of artists

3. <https://research.gold.ac.uk/id/eprint/3111/1/osembroidery.htm>

who have investigated the relationship of handcrafted embroidery with open-source programming.

*Victoria Bradbury* is also a contemporary artist that makes use of electronic materials applied to textiles to conceptualize her artistic expressions. With a vast work of participatory and experimental artifacts that stage common objects, the artist highlights them as tools to explore historical, social or political systems. An example is the *Witch Pricker* installation where she reinvents the witch persecution that took place in 1649 in Newcastle, UK. Victoria explores a new vision of the limits of the traditional with works conceived in the scope of *Maker Culture* and combines tradition and technology in new artistic practices for the 21st century and its coexistence with established traditional practices (Bradbury 2013).

The variety of kits available nowadays – where it is even possible to create the exact kit with the components needed for each project (Martinez 2019; Perner-Wilson 2014) – offer alternative opportunities for reinventing and renewing traditional materials. The modernization in the way of communicating *Living Wall* (Buechley 2010), storytelling through playful interactions using conductive ink<sup>4</sup> or the most sophisticated technological fashion projects, such as the work of Hussein Chalayan<sup>5</sup> or the project *Caress of the Gaze* designed by Behnaz Farahi (2015).

Electronic materials with applicability to textiles through needlework open up infinite possibilities for the design and implementation of digital artifacts, which, when designed under the artisanal aegis, allow the rediscovery of craft techniques, deconstructing their initial logic, reinventing and introducing them. In the contemporary imagination, as an example of the digital artifact Filozell-e described in 3.1. These digital artifacts created from the exploration of soft circuits work with the surfaces of the objects themselves, in the construction of interfaces that will acquire meaning from the relationship with the public in space. Sometimes, the system behind the interface is able to react to received stimuli, changing its own state and adapting it to the response (Neto 2020). It should be noted that works created with soft circuits differ from common technical interfaces because they have aesthetic or even conceptual concerns related to the poetic project of a craftsman/artist.

Today, with computing through the use of sensors and other programmed interfaces with algorithms and associated with the artistic object, issues related to reality, representation, illusion, landscape, space, shape, color, texture, movement, composition and content that permeated pictorial production and sculpture for centuries can continue to be approached in different ways in the work of art. The use of technology and soft circuits thus work as inducers of aesthetic possibilities through their ability to articulate space, time or ideas in the development of functional conceptual interfaces or aesthetic enjoyment that characterize contemporary art.

4. <https://vimeo.com/121878247>

5. Design Museum (2014)  
Hussein Chalayan – profile.  
<https://designmuseum.org/designers/hussein-chalayan>

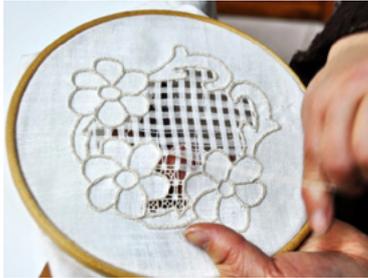
## 2.2 Traditional Embroidery: the Portuguese Case

Over the centuries, the traditional embroideries of Portugal were considered symbols of wealth, power and a reference of social class. As a textile art, they have always represented a considerable weight in the economic activities of the environment in which they operate, even if they are conditioned by the types of raw material available. In Portugal, each region has its own embroidery style, which incorporates the culture, environment and images of its history and tradition (Pires 2009). The technique and imagination of the raw material and the narrative are transferred from generation to generation. The embroiderers receive this legacy from their childhood family, finding the feminine world in their embroideries. These first assume themselves as artisans and only later, in rare cases, as artists or creators. The surrounding space, that internal image that is so present in your memory, is transferred to paper, then to fabric and takes shape with the needle and thread. It arrives at this stage, loaded with symbolism and narrative.

Currently, the following embroideries are registered in Portugal: Embroidery of Arraiolos, of Nisa or Alinhavos of Nisa, of Castelo Branco (Pinto et al. 1992), of Caldas da Rainha (Carvalho 2019; Tavares 1999) or of D. Leonor, of Airães, of *Filé*, of Tibaldinho (Pereira 2017; Teixeira 1998), of Guimarães, of Viana do Castelo, of Madeira and of the Azores. Although traditional embroideries have a conceptual basis inspired by the cultural and traditional ambience of the area where they are located, the traditional embroideries of Nisa, Guimarães, Airães, Tibaldinho and S. Miguel (Azores) exceptionally display themes that are mostly vegetal. This focus on floral elements was particularly inspiring for the creation of the artistic project that will be described later on (see 3.1). The traditional embroidery of the island of Faial stands out, using straw collected from the environment as raw material (Silva 2006).

The predominant base in traditional embroidery is linen and cotton; the exception is the Arraiolos embroideries (produced on “jute”) and the *Filé* embroideries (produced on net constructed using knots and fixed in wooden frames). As for the stitches used, these are repeated in the different embroideries, standing out as predominant: the full stitch, the sieve, the cord, the open hem, and the flower stitch (Magalhães 1995).

**Table 1.** Certified embroidery in Portugal: summary of the main types and its characteristics.

Embroidery style	Allusive image	Most evident features
Embroidery of Arraiolos	 <p data-bbox="748 618 989 647"><a href="https://goo.gl/JNvpxp">https://goo.gl/JNvpxp</a></p>	<p>With an ancestral history, Arraiolos embroideries were grouped into three epochs, the current one being characterized by simplification of motifs, geometrization of shapes, creation of patterns, monochromatic and low-contrast polychromatic combinations. The base is a natural fiber and the wools are colored, have a larger gauge and a special twist in order to be resistant to use.</p>
Embroidery of Nisa	 <p data-bbox="748 1234 989 1263"><a href="https://goo.gl/i6Ded3">https://goo.gl/i6Ded3</a></p>	<p>The Nisa embroidery are embroidered in white on linen cloth or sieve-embroidered cotton, which gives them great resistance.</p> <p>The theme is mostly vegetal, with floral and natural motifs.</p>
Embroidery of Castelo Branco	 <p data-bbox="748 1603 989 1632"><a href="https://goo.gl/udwbv2">https://goo.gl/udwbv2</a></p>	<p>The Castelo Branco embroidery involves a very specific symbolism: the two-headed bird represents two souls in a body, the trees represent life, the carnations allegorize the man, the roses the woman, among others. It is made with the linen stretched in a circular or rectangular frame. The most common stitch is the loose stitch or wide stitch.</p>

Embroidery  
of Caldas  
da Rainha



<https://goo.gl/3hzJ8u>

Initially with linen threads, dyed by cooking in teas of different plants and flowers of *carqueja*, which gave them the uncertainty of the color and the tint. Currently, the three-tone cotton thread is embroidered on fine-textured linen fabric. It takes the form of an arc, spiral, angles, repetitions, hearts, respecting the symmetry in all imagery.

Embroidery  
of Airões



<https://goo.gl/QqmiVv>

Shape of sieves and open hems. The fabric to be embroidered is usually linen or chambray. Cotton yarn is the most used regarding the velvet stitch of this typology. The motifs are related to the fauna and flora of the region, namely the grape bunches, cob, floral compositions, butterflies, fish and bows.

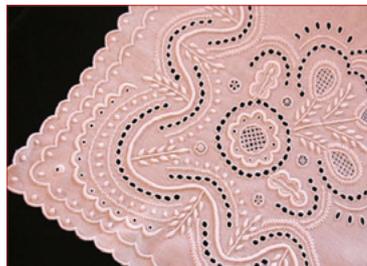
Embroidery  
of Filé



<https://goo.gl/4adw6E>

*Filé* embroidery makes use of a net as a work base, and is made from raw or white yarn. This net features small squares that vary in size according to the intended work. Solid stitches, cross stitches and the finishing stitch are used.

Embroidery  
of Tibaldinho



<https://goo.gl/FuVDnC>

*Tibaldinho* embroideries are harmonious and predominantly white, on linen. They use open and solid stitches, such as the cord stitch, cutout stitch and sieves. Decorative motifs choose the arch in terms of the cutout and borders of each theme that form circles, spirals, loops, stars and sieve in geometric shapes.

Embroidery  
of Guimarães



<https://goo.gl/mY3gZb>

With industrial linen as a support, the composition focuses on the local fauna and flora, birds, flowers, stars, borders and bows. The compositions are embroidered with DMC cotton thread and in monochrome in red, blue, beige, white, gray and black.

Embroidery  
of Viana do  
Castelo



<https://goo.gl/oM1kh8>

The base is handmade linen and DMC cotton lines, in white, red and blue, are the most used. Other materials are wool and golden thread cord to outline the designs giving them more emphasis. Recently, the golden thread has been replaced by a white thread, linking the main designs together by branches, curls, brambles and angles.

Embroidery  
of Madeira



<https://goo.gl/gfxyXH>

Madeira embroidery is crafted on linen, silk, cotton or organdy, and the most used stitches are buttonhole, richelieu, flower foot, among others. The official stitch is the “cord stitch” used in the contours of cutout motifs, on light textured fabrics.

Embroidery  
of the Azores



<https://goo.gl/JR2ZBi>



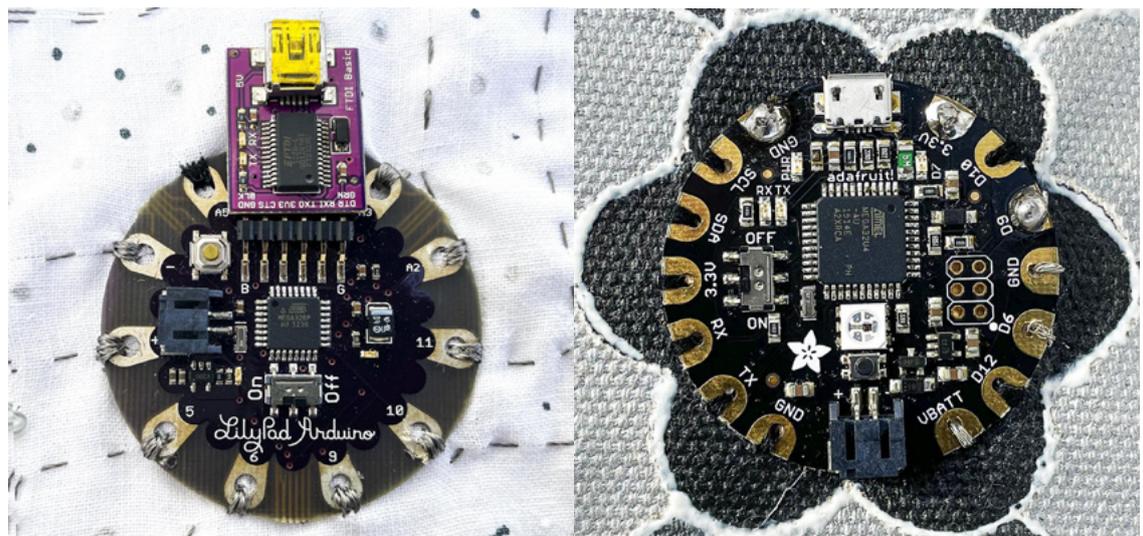
<https://goo.gl/YPHwhm>

Specificity is characterized according to the tradition of each island where they are produced. The Island of São Miguel recreates, in hues, asymmetrical floral elements such as clovers, ferns, branches and some birds, inspired by the decoration of Chinese tableware. It uses two shades of blue, cotton thread on linen, cotton or white chambray fabric.

### 2.3 Electronics applied to Soft Circuits

In *e-embroidery*, physical computing takes place through hardware and software specific to its design, requiring code design with experimental flexibility, with its subjective dimension of creativity directly impacting the type of aesthetic object produced and the response provoked by and in the participant. Regarding the soft circuits as potentiators of new contemporary aesthetics, we highlight the characteristics of the *LilyPad* and *Flora* microcontrollers. This type of hardware consists of prototyping platforms based on the principle of inputs and outputs. Inputs can be used in the form of a button, switch or sensor. Data from sound, movement, temperature and light can be processed by the microcontroller, in the same way that it allows connecting a large number of inputs and simultaneously controlling a large series of production outputs – light and movement or more complex outputs, such as sending short SMS messages. Both brands offer various electronic components and conductive wires, which can be used as soft circuits, combined in traditional craft processes (sewing, fashion design and textile design) with electronic engineering, computer science and hardware skills. Interactive embroidery uses these e-materials as a resource, insofar as they articulate with the environment, communicate through interactive multi-purpose languages, establish conceptual dialogues, acquire new functionalities, prove to be challenging in the tracing of the creative imagination and indicate a shift towards the artistic system of interactive or responsive interfaces to the medium, part of a digital culture oriented towards the visual, sensorial and non-linear, where the user is the context of the work of art.

Fig. 3. Microcontrollers and other series electronic components applied to e-embroidery: *LilyPad Arduino* and LEDs, RGB LED, buzzer and vibrate board (left); *Flora Adafruit* and LEDs (right). Source: paper authors.



The software used to program the e-embroidery interactive subsystems is the Arduino IDE. For the schematic design of the circuits and systems and to simulate the functionalities it is possible to use tools freely available online, such as *Fritzing*<sup>6</sup> or *TinkerCad*<sup>7</sup>. *Fritzing* is an open-source software, specific for the

6. <https://fritzing.org>

7. <https://www.tinkercad.com/things?type=circuits>

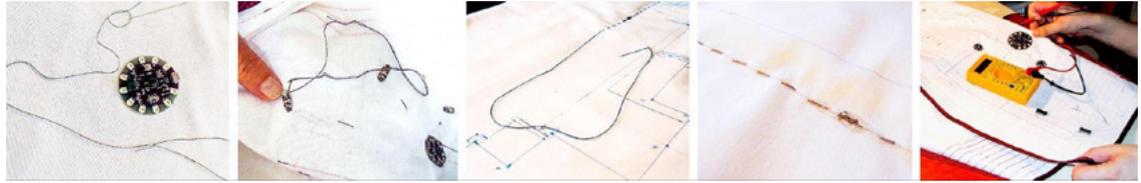
design of electronic circuits in an accessible and creative way, presenting them in schematic or breadboard form. Both applications contain several icon libraries alluding to different components from different brands and the possibility of processing diverse Arduino board versions. By building creative interaction systems and enabling users to previously test, these tools allow users to document their prototypes, share them with others, teach electronics in the classroom and test the system layouts they build.

### 3. Artistic Practices combining Portuguese Embroidery and Soft Circuits

When we combine electronic materials with craftsmanship, we explore electronic components, using abstract schemes with applicability to traditional or common materials. Thus, Turkle and Papert (1990) “interactive crafts suggest alternative physical, intellectual and cultural paths for electronic materials”. According to these authors, supporting different styles of approach is important not only for cognitive but also emotional reasons. Our research with young students (graduates in Basic Education), illustrate how they derive pleasure from the way of working with handicrafts, reinventing it in terms of exploring new technological materials, using different textures, innovating in the aesthetic, expressive and functional aspects, recording the importance of preserving knowledge and the mental challenge that the application of electronics requires.

As for e-embroidery, we mean textiles embroidered with conductive thread, conductive fabrics, conductive fibers and/or the integration of technological materials in non-conductive fabrics (Bost . and Crosetto 2014). Embroidery using soft circuits with applicability in textiles should consider the indications illustrated in figure 4: (1) start by threading a needle with the conductive thread that currently appears as a stainless-steel thread wrapped in cotton. Pull the thread through the eye of the needle to a length of 30 cm. Tie a knot at the end of the thread. (2) Thread the needle through the back of the fabric, adjusting the knot securely. Push the needle through the fabric again, approximately 5 mm away. This time, the needle moves from the front to the back of the fabric. (3) At the finishing knot, bring the needle to the back side of the fabric through your last stitch. Finish with a small loop of yarn on the fabric surface. Seal with a little glue or nail varnish to prevent the lead wire from stretching and altering the conduction. (4) In the textile article, the embroidery is constructed on a design from the back of the work, preferably on a self-adhesive non-textile fabric, making the certification of the connections between the assembly of each component, individually and progressively. Our experimentation led us to the conclusion that traditional embroidery must be performed on the front of the fabric, in a stage prior to the assembly of the electronic system. Figure 4 shows the technique used in sewing soft circuits to the textile.

**Fig. 4.** Technique of Sewing electronic materials to textile:  
1. Preparation of materials;  
2. Base design and basting;  
3. Sew of an LED; 4. Node sealing;  
5. Current control after each turn on. Source: paper authors.



### 3.1 The Filozell-e Interactive Artifact

The interactive digital artifact Filozell-e is presented in the form of an embroidered and painted linen tapestry. It supports two microcontrollers and a number of actuators that, as programmed, respond to two sensors – proximity and ambient sound. The conceptualization of the project is based on three realities: symbiosis between design and technology, which results in original artistic expressions within the scope of creativity and aesthetics; interaction between humans and machines through interactive communication, seeking to explore the improvement of communication between them; and the reality of traditional embroidery that fight for its preservation and valorization, in this case applied to the culture of Santa Catarina da Fonte do Bispo, Tavira, Portugal. These themes are the foundations for the research that served as the basis for the design of the project, which studies how the new aesthetics of Digital Art can contribute to reactivate the interest and enrich the Traditional Embroidery of Portugal, deconstructing its logic, thus reintroducing embroidery into the contemporary imaginary.

Concept design included sketches and varied designs, which allowed us to envision different possible embodiments for the starting idea, in the sense of establishing an initial attempt that would be part of a more complex final composition.

The first step to materialize the abstraction of the concept in a tangible structure in perspective was a photographic documentation of the autochthonous species of local flora at Santa Catarina da Fonte do Bispo, Tavira, Portugal, followed by graphic sketches, the simplification by leveling the design of the species and color studies (Fig. 5).

The design of the experiment took into account important aspects of human nature in terms of stimuli and attention, considering knowledge and skills in areas such as perceptual psychology, science of cognition, environmental design, haptics, informational content design, interaction design, heuristic computing and design thinking.

**Fig. 5.** Photo to document autochthonous species of flora in the region of Santa Catarina da Fonte do Bispo, Tavira, Portugal, (the Cardo, *Cynara Cardunculus*) and its simplified graphic sketch. Resulting design was simplified by leveling the species design and color study, distinguishing the different shades that were applied in the final work (dimensions 1000 mm x 1500 mm). Source: paper authors.



The design of the concept, narrative and experience outline was followed by the development of the artifact, culminating in the realization of the final physical artifact. This phase included the design of the matrix, the transition from the matrix to the fabric, the outline of the design on the textile, the painting of the textile, outline of details, hand embroidery, system design, code programming and physical prototype tests and the production of the artifact exploring functional and aesthetic considerations, oriented to the realization of the concept.

**Fig. 6.** Sequence of the pattern design on the fabric (left) and hand embroidery applying the *Pé de Flor* stitch (right). Source: paper authors.



**Fig. 7.** Implementation of Arduino electronic circuits (left), testing the response of the actuators to the data sent to the microcontroller by the ambient sound sensor. Details of technology integration: application of *Neopixel Flora* and interaction with a motion sensor that activates the LED light by human proximity (right). Source: paper authors.



**Fig. 8.** Visitor interacting with the final version of the artifact Filozell-e, publicly displayed at ARTeFACTO 2018, *1st International Conference on Transdisciplinary Studies in Arts, Technology and Society* (right). Source: <https://bit.ly/3LSzOmn>



Regarding the implementation of the artifact, technology was then integrated (figure 7), followed by use and validation of the system and debug tests, planning of the display of the artifact Filozell-e (figure 8) and finally the deployment of the artifact as finished work as it was presented in public exhibitions.

### 3.2 Streamlining Embroidery and Building Community Workshops

Soft circuits applied to traditional embroidery propose to conceptualize new poetics, new functionalities and contribute to new forms of dissemination and promotion of local populations. The progress of the research is currently focused on the design of a set of guidelines and its implementation towards a new embroidery operationalized in participatory environments and work with the community.

Seeking to return and expand artistic practices to the communities of embroiderers and digital artists, we planned and promoted a workshop on the theme “Soft Circuits in Traditional Embroidery: Reinvention of an Imaginary for Sustainability”. In an initial phase, the activity was planned to stimulate a group of students in the last year of the Degree in Basic Education. The concept was presented, and students’ suggestions were considered, so adjustments were made in order to optimize the learning curve with a public that is usually unfamiliar with physical computing. From this experience, the workshop will be optimized in order to expand to local communities where traditional embroidery is practiced, seeking to attract multidisciplinary audiences and bring together different generations - usually older participants hold traditional knowledge and the younger ones contribute by learning the technologies that are needed to implement the desired interactive prototypes.

The implementation of the laboratory work, which resulted in a set of samples that served as motivation for the workshop, was based on sustainability at the cultural level (to the extent that we meet the past, we rely on existing visual metaphors resulting from traditional knowledge), environmental (we make art inspired by the surrounding environment and with zero waste, collecting traditional embroidery, with the possibility of reusing the materials in artistic works)

and economic (in a well-implemented system, it could be a source of income for embroiderers/digital artists).

As main objectives, the production of sustainable art stands out in this context, combining traditional materials and techniques with electronic components, reinventing embroidery in a sustainable way by proposing its reintroduction into the contemporary imaginary.

With this laboratory activity, we intend to address the potential of soft circuits applied to textiles, in terms of their innovation and reinvention of an imaginary. We proposed to study the articulation between electronic materials and traditional embroidery, the innovation of emerging proposals, their importance in contemporary art and the conceptual and constructive aspects linked to sustainability. The embroideries that served as the basis for exploration during the workshop were selected according to the following parameters:

- × Hand-embroidered proposals;
- × Embroidered pieces with ancestral essence in terms of design or fabric (preferred options were cotton or linen);
- × The preference for embroidered pieces in which there was an emotional or conceptual involvement.

Fig. 9. Exploration of technological materials and sewing microcontrollers in embroidery. Source: paper authors.



Fig. 10. Exercise development 8: *Lilypad*, temperature sensor and *Lilypad* leds that light up when temperature decreases. Source: paper authors.



All participants showed interest and taste for learning about this topic, and a lot of motivation for a future application, suggesting hypotheses for application and exploration during their professional activity as basic education teachers. The sustainability of interactive embroidery was also a matter of interest for future study and experimentation. In order to minimize the biggest problem experienced in this workshop, specifically the lack of knowledge of the sewing technique and stitches used in embroidery, it was suggested by the participants that in future workshops, invitations should be addressed to embroiderers in the area or family members of the participants.

Participation would then become a means for the exchange of knowledge between traditional embroidery and new technologies, as the technique, imagination, raw material and the narrative have always been passed on from generation to generation. Traditional Embroidery is a legacy inherited from the childhood family, so narratives are loaded with symbolism created by ancestral generations, internal images resulting from experiences passed on to paper, then to fabric and finally take shape with the needle and thread. These intergenerational bonds are an area to nurture in future iterations of our research.

#### 4. E-Aesthetics towards Cultural Sustainability

By nature, traditional crafts integrate references to their environment and communicate cultural values and social realities. The creative exploration of these culturally rooted practices with the possibilities of soft circuits has given way to intergenerational exchange, thus leading to the preservation of memories and revitalization of traditional crafts.

In this scope, a digital artifact – Filozell-e - was created and implemented using soft circuits applied to textiles. It can be conceptualized as an invitation to interactive experiences with the realities of the surrounding environment.

Complementarily, the workshops on interactive embroidery have been exploratory activities that contribute to validate the research in terms of cultural sustainability, insofar as we meet the past, and for the recognition of the other, their experiences and choices, collecting and choosing the objects that serve as a basis for the creation of visual metaphors from the reinvention and renovation of existing embroideries. This social extension also proposes to contribute to the guidelines for the development of populations and rural spaces, associated with principles of economic sustainability in terms of the circular economy and creative industries.

Based on the feedback from embroiderers, students and users, ideas have been confronted, from which we conclude that the works of art that make use of the combination of technological materials with embroidery, are artistic explorations focused on the exploration of innovation platforms, technology, new construction processes, new approaches and new readings for embroidered objects

that are considered traditional. By reinventing themselves, these artworks are presented as a medium for artistic interfaces that suggest physical, intellectual, and cultural paths supporting different styles of cognitive and emotional approach. The resulting artworks create dialogic relationships with the user and the environment, suggesting an active participation through touch, approach, response to light or sound. They remind us of the importance of preserving popular knowledge through creative and conceptual challenges of creating an artistic nature.

The shift of the artistic object into the cultural system gives purpose to the sustainable reconversion of societies and brings awareness to the work of artisans as artists. It is then pertinent to carry out new e-aesthetic explorations that combine traditional and electronic arts, establishing connections where signs of a collective consciousness become part of our cultural sustainability.

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